CLAIMS:

1. A method of interpolating a first set of discrete sample values to generate a second set of discrete sample values using one of a plurality of interpolation kernels, characterised in that said interpolation kernel is selected depending on an edge strength indicator, an edge direction indicator and an edge context indicator for each discrete sample value of said first set.

2. The method according to claim 1, wherein said interpolation kernel is a universal interpolation kernel, *h(s)*.

3. The method according to claim 2, wherein said universal interpolation kernel, *h(s)*, is of the form:

$$h(s)=\begin{cases}1, & 0\le|s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^3+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^2+(1-\frac{1}{3}b), & d<|s|\le 1-d\\ 0, & 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^3+(b+5c)\left|\frac{s-3d}{1-2d}\right|^2+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), & 1+d<|s|\le 2-d\\ 0, & \mathit{Otherwise}\end{cases}$$

and wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

4. The method according to claim 1, wherein said plurality of kernels are given by:

$$h(s_x,s_y)_{\theta=0}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5}\cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2}=\frac{1}{\sqrt{2}}\left\{\mathrm{h}(s_x)_{c=0}\cdot h(s_y)_{c=0.5}\right.$$

$$h(s_x, s_y)_{\theta=\pi/4} = \frac{1}{\sqrt{2}}\left\{ h\left(\frac{s_x + s_y}{2}\right)_{c=0.5} \cdot h\left(\frac{s_x - s_y}{\sqrt{2}}\right)_{c=0} \right\}$$

$$h(s_x, s_y)_{\theta=3\pi/4} = \frac{1}{\sqrt{2}}\left\{ h\left(\frac{s_x + s_y}{\sqrt{2}}\right)_{c=0} \cdot h\left(\frac{s_x - s_y}{2}\right)_{c=0.5} \right\},$$

and wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

5. The method according to claim 1, wherein said first set of discrete sample values are at a different resolution to said second set of discrete sample values.

Sub D1

6. A method of interpolating a first set of discrete sample values to generate a second set of discrete sample values using an interpolation kernel, characterised in that said interpolation kernel are selected depending on an edge strength indicator, an edge direction indicator and an edge context indicator for each discrete sample value of said first set.

Sub C1

7. The method according to claim 6, wherein said interpolation kernel is a universal interpolation kernel, $h(s)$.

8. The method according to claim 7, wherein said universal interpolation kernel, $h(s)$, is of the form:

$$h(s)=\begin{cases}1, & 0\le|s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^{3}+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^{2}+(1-\frac{1}{3}b), & d<|s|\le 1-d\\ 0, & 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^{3}+(b+5c)\left|\frac{s-3d}{1-2d}\right|^{2}+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), & 1+d<|s|\le 2-d\\ 0, & \mathit{Otherwise}\end{cases}$$

and wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

9. The method according to claim 6, wherein said first set of discrete sample values are at a different resolution to said second set of discrete sample values.

Sub B27

10. A method of interpolating image data, said method comprising the steps of:

accessing a first set of discrete sample values of said image data;

calculating kernel values for each of said discrete sample values using one of a plurality of kernels depending upon an edge orientation indicator, an edge strength indicator, and an edge context indicator for each of said discrete sample values; and

convolving said kernel values with said discrete sample values to provide a second set of discrete sample values.

11. The method according to claim 10, wherein said kernel is a universal interpolation kernel, *h(s)*.

12. The method according to claim 11, wherein said universal interpolation kernel, *h(s)*, is of the form:

$$h(s)=\begin{cases}1, & 0\le|s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^3+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^2+(1-\frac{1}{3}b), & d<|s|\le 1-d\\ 0, & 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^3+(b+5c)\left|\frac{s-3d}{1-2d}\right|^2+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), & 1+d<|s|\le 2-d\\ 0, & Otherwise\end{cases}$$

and wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

13. The method according to claim 11, wherein said plurality of kernels are given by:

$$h(s_x,s_y)_{\theta=0}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5}\cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0}\cdot h(s_y)_{c=0.5}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/4}=\frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{2}\right)_{c=0.5}\cdot h\left(\frac{s_x-s_y}{\sqrt{2}}\right)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=3\pi/4}=\frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{\sqrt{2}}\right)_{c=0}\cdot h\left(\frac{s_x-s_y}{2}\right)_{c=0.5}\right\},$$

and wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

14. The method according to claim 10, wherein said first set of discrete sample values are at a different resolution to said second set of discrete sample values.

15. An apparatus for interpolating image data, said apparatus comprising:

means for accessing a first set of discrete sample values of said image data;

calculator means for calculating kernel values for each of said discrete sample values using one of a plurality of kernels depending upon an edge orientation indicator, an

edge strength indicator, and an edge context indicator for each of said discrete sample values; and

convolution means for convolving said kernel values with said discrete sample values to provide a second set of discrete sample values.

16. The apparatus according to claim 15, wherein said kernel is a universal interpolation kernel, *h(s)*.

17. The apparatus according to claim 16, wherein said universal interpolation kernel, *h(s)*, is of the form:

$$h(s)=\begin{cases}1, & 0\le|s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^3+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^2+(1-\frac{1}{3}b), & d<|s|\le 1-d\\ 0, & 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^3+(b+5c)\left|\frac{s-3d}{1-2d}\right|^2+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), & 1+d<|s|\le 2-d\\ 0, & Otherwise\end{cases}$$

and wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

18. The apparatus according to claim 15, wherein said plurality of kernels are given by:

$$h(s_x,s_y)_{\theta=0}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5}\cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0}\cdot h(s_y)_{c=0.5}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/4}=\frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{2}\right)_{c=0.5}\cdot h\left(\frac{s_x-s_y}{\sqrt{2}}\right)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=3\pi/4} = \frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{\sqrt{2}}\right)_{c=0} \cdot h\left(\frac{s_x-s_y}{2}\right)_{c=0.5}\right\},$$

and wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

19. The method according to claim 15, wherein said first set of discrete sample values are at a different resolution to said second set of discrete sample values.

Sub B4

20. A computer readable medium for storing a program for an apparatus which processes data, said processing comprising a method of interpolating image data, said program comprising:

code for accessing a first set of discrete sample values of said image data;

code for calculating kernel values for each of said discrete sample values using one of a plurality of kernels depending upon an edge orientation indicator, an edge strength indicator, and an edge context indicator for each of said discrete sample values; and

code for convolving said kernel values with said discrete sample values to provide a second set of discrete sample values.

Sub C1

21. The computer readable medium according to claim 20, wherein said kernel is a universal interpolation kernel, $h(s)$.

22. The computer readable medium according to claim 21, wherein said universal interpolation kernel, $h(s)$, is of the form:

$$h(s)=\begin{cases}1, & 0\le|s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^3+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^2+(1-\frac{1}{3}b), & d<|s|\le 1-d\\ 0, & 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^3+(b+5c)\left|\frac{s-3d}{1-2d}\right|^2+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), & 1+d<|s|\le 2-d\\ 0, & Otherwise\end{cases}$$

and wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

23. The computer readable medium according to claim 21, wherein said plurality of kernels are given by:

$$h(s_x,s_y)_{\theta=0}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5}\cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0}\cdot h(s_y)_{c=0.5}\right.$$

$$h(s_x,s_y)_{\theta=\pi/4}=\frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{2}\right)_{c=0.5}\cdot h\left(\frac{s_x-s_y}{\sqrt{2}}\right)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=3\pi/4}=\frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{\sqrt{2}}\right)_{c=0}\cdot h\left(\frac{s_x-s_y}{2}\right)_{c=0.5}\right\},$$

and wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

Sub C1 24. The computer readable medium according to claim 20, wherein said first set of discrete sample values are at a different resolution to said second set of discrete sample values.

25. A method of interpolating image data comprising a first mapping of discrete sample values, said method comprising the steps of:

(i) identifying text regions within said first mapping and labelling each discrete sample value within each text region;

(ii) calculating edge information for each of said discrete sample values of said image data to identify edge sample values and storing an angle of orientation for each of said edge sample values;

(iii) combining said labels and said angle of orientation for each of said discrete sample values to form a second mapping of said discrete sample values;

(iv) manipulating said angle of orientation for each edge sample value within said second mapping to form a third mapping of said discrete sample values;

(v) manipulating said image data of said third mapping to form a fourth mapping of said image data; and

(vi) interpolating each sample value of said fourth mapping with a first one of a plurality of kernels depending on said labels and said angle of orientation of each of said sample values of said fourth mapping to form a fifth mapping of said image data.

26. The method according to claim 25, wherein step (v) comprises the following sub-steps:

(v)(a) associating each discrete sample value of said fourth mapping with a corresponding discrete sample value of said third mapping;

(v)(b) scaling said third mapping of said image data based on said association.

27. The method according to claim 25, wherein step (v) comprises the step of interpolating said image data of said third mapping using a second kernel.

28. The method according to claim 26, wherein said second kernel is an NN interpolation kernel.

29. The method according to any one of claim 25, wherein said labels and said angle of orientation of each of said sample values of said fourth mapping are used to select kernel parameter values of said first kernel.

30. The method according to claim 25, wherein said first kernel is a universal interpolation kernel, *h(s)*.

31. The method according to claim 30, wherein said universal interpolation kernel, *h(s)*, is of the form:

$$h(s)=\begin{cases}1, \quad 0\le |s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^3+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^2+(1-\frac{1}{3}b), \quad d<|s|\le 1-d\\ 0, \quad 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^3+(b+5c)\left|\frac{s-3d}{1-2d}\right|^2+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), \quad 1+d<|s|\le 2-d\\ 0, \quad Otherwise\end{cases}$$

wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

32. The method according to claim 25, wherein said plurality of kernels are given by:

$$h(s_x,s_y)_{\theta=0}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5}\cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0}\cdot h(s_y)_{c=0.5}\right.$$

$$h(s_x,s_y)_{\theta=\pi/4}=\frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{2}\right)_{c=0.5}\cdot h\left(\frac{s_x-s_y}{\sqrt{2}}\right)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=3\pi/4}=\frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{\sqrt{2}}\right)_{c=0}\cdot h\left(\frac{s_x-s_y}{2}\right)_{c=0.5}\right\}$$

wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

33. The method according to claim 25, wherein said steps (i) to (vi) are carried out on one of a plurality of portions of said first mapping of discrete sample values of said image data.

34. The method according to claim 25, wherein the labels take precedence over said angle of orientation when forming said second mapping of said discrete sample values

35. The method according to claim 25, wherein said fourth mapping is at a different resolution to said first mapping.

36. The method according to claim 25, wherein said image data is colour image data.

37. The method according to claim 36, wherein steps (i) and (ii) are carried out for each colour plane of said colour image data.

38. The method according to claim 36, wherein steps (i) and (ii) are carried out for a luminance component of said colour image data.

39. The method according to claim 25, wherein step (i) includes the following sub-steps:

(i)(a) calculating a text indicator value, C; and

(i)(b) comparing said text indicator value with a threshold value, wherein said labelling of each discrete sample value within each text region is based on said comparison.

40. The method according to claim 39, wherein said text indicator, C, is of the form:

$C = \max(|P_0 - P_i|), \quad i \in 1,..,8$

and wherein i is the index of the 8 nearest neighbour discrete sample values to a centre discrete sample value, $P0$.

41. The method according to claim 39, wherein step (i) includes the following sub-step:

(i)(c) performing a cleaning operation on said text labels.

42. The method according to claim 41, wherein said cleaning operation is a morphological opening operation.

43. The method according to claim 25, wherein step (ii) includes the following sub-steps:

(ii)(a) calculating edge response values for each of said discrete sample values;

(ii)(b) calculating a gradient magnitude value based on said edge response values; and

(ii)(c) comparing said gradient magnitude value with a threshold value;

(ii)(d) classifying a current pixel on the basis of said comparison;

(ii)(e) calculating said angle of orientation for a current pixel based on said comparison; and

(ii)(f) storing said angle of orientation.

44. The method according to claim 43, wherein said gradient magnitude value, Gm, is of the form:

$G_m = \sqrt{G_v^2 + G_h^2}$, and

wherein Gv and Gh are the vertical and horizontal edge responses, respectively.

45. The method according to claim 43, wherein said edge gradient value, $G6$, is of the form:

$$G_\theta = \tan^{-1}\frac{G_v}{G_h},$$

wherein Gv and Gh are the vertical and horizontal edge responses, respectively.

46. The method according to claim 25, wherein step (iv) includes the following sub-steps:

(iv)(a) accumulating a number of discrete data values of each angle of orientation for one of a plurality of portions of said discrete data values;

(iv)(b) calculating a highest value and lowest value of discrete sample values for each angle of orientation;

(iv)(c) comparing said highest and lowest values with highest and lowest threshold values, respectively;

(iv)(d) reassigning an angle of orientation of said discrete data values of said portion on the basis of said comparison; and

(iv)(e) repeating steps (iv)(a) to (iv)(e) for each of said portions of said discrete data values.

47. The method according to claim 46, wherein said plurality of portions of said discrete data values is five portions.

48. The method according to claim 25, wherein a modified cubic interpolation kernel is applied to a discrete data value which is labelled as text.

49. The method according to claim 48, wherein said modified cubic interpolation kernel, *h(s)*, is of the form:

$$h(s) = \begin{cases} 1, & -d < s \le d \\ 0, & (1-d) \ge s > (1-d) \\ 2\left|\frac{s-d}{1-2d}\right|^3 - 3\left|\frac{s-d}{1-2d}\right|^2 + 1, & \end{cases}$$

wherein $s = t/\Delta t$ is a normalised coordinate that has integer values at a sample point and $0 \le d < 0.5$.

50. The method according to claim 25, wherein a steerable cubic interpolation kernel is applied to a discrete data value which is classified as an edge.

51. The method according to claim 50, wherein said steerable cubic interpolation kernels, $h(sx,sy)$, are of the form:

$$h(s_x,s_y)_{\theta=0} = \frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5} \cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2} = \frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0} \cdot h(s_y)_{c=0.5}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/4} = \frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{2}\right)_{c=0.5} \cdot h\left(\frac{s_x-s_y}{\sqrt{2}}\right)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=3\pi/4} = \frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{\sqrt{2}}\right)_{c=0} \cdot h\left(\frac{s_x-s_y}{2}\right)_{c=0.5}\right\}$$

wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

52. The method according to claim 50, wherein a conventional cubic interpolation kernel is applied to a discrete data value which is classified as smooth.

53. The method according to claim 52, wherein said conventional cubic interpolation kernel is of the form:

$$h(s) = \begin{cases} (2-\frac{3}{2}b-c)|s|^3 + (-3+2b+c)|s|^2 + (1-\frac{1}{3}b), & |s| \le 1 \\ (-\frac{1}{6}b-c)|s|^3 + (b+5c)|s|^2 + (-2b-8c)|s| + (\frac{4}{3}b+4c), & 1 < |s| \le 2 \\ 0, & Otherwise \end{cases}$$

and wherein $b = 0$ and $c = 0.5$.

54. An apparatus for interpolating image data comprising a first mapping of discrete sample values, said apparatus comprising:

means for identifying text regions within said first mapping and labelling each discrete sample value within each text region;

first calculating means for calculating edge information for each of said discrete sample values of said image data to identify edge sample values and storing an angle of orientation for each of said edge sample values;

combining means for combining said labels and said angle of orientation for each of said discrete sample values to form a second mapping of said discrete sample values;

manipulating means for manipulating said angle of orientation for each edge sample value within said second mapping to form a third mapping of said discrete sample values, and manipulating said image data of said third mapping to form a fourth mapping of said image data; and

interpolation means for interpolating each sample value of said fourth mapping with a first one of a plurality of kernels depending on said labels and said angle of orientation of each of said sample values of said fourth mapping to form a fifth mapping of said image data.

55. The apparatus according to claim 54, wherein said apparatus further comprises:

associating means for associating each discrete sample value of said fourth mapping with a corresponding discrete sample value of said third mapping;

scaling means for scaling said third mapping of said image data based on said association.

56. The apparatus according to claim 54, said apparatus further comprising interpolation means for interpolating said image data of said third mapping using a second kernel.

57. The apparatus according to claim 56, wherein said second kernel is an NN interpolation kernel.

58. The apparatus according to any one of claim 54, wherein said labels and said angle of orientation of each of said sample values of said fourth mapping are used to select kernel parameter values of said first kernel.

59. The apparatus according to claim 54, wherein said first kernel is a universal interpolation kernel, *h(s)*.

60. The apparatus according to claim 59, wherein said universal interpolation kernel, *h(s)*, is of the form:

$$h(s)=\begin{cases}1, & 0\le |s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^3+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^2+(1-\frac{1}{3}b), & d<|s|\le 1-d\\ 0, & 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^3+(b+5c)\left|\frac{s-3d}{1-2d}\right|^2+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), & 1+d<|s|\le 2-d\\ 0, & Otherwise\end{cases}$$

wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

61. The apparatus according to claim 54, wherein said plurality of kernels are given by:

$$h(s_x,s_y)_{\theta=0} = \frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5}\cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2} = \frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0}\cdot h(s_y)_{c=0.5}\right.$$

$$h(s_x,s_y)_{\theta=\pi/4} = \frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{2}\right)_{c=0.5}\cdot h\left(\frac{s_x-s_y}{\sqrt{2}}\right)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=3\pi/4} = \frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{\sqrt{2}}\right)_{c=0}\cdot h\left(\frac{s_x-s_y}{2}\right)_{c=0.5}\right\}$$

wherein $s_x= x/\Delta x$ and $s_y=y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

62. The apparatus according to claim 54, wherein the labels take precedence over said angle of orientation when forming said second mapping of said discrete sample values

63. The apparatus according to claim 54, wherein said fourth mapping is at a different resolution to said first mapping.

64. The apparatus according to claim 54, wherein said image data is colour image data.

65. The apparatus according to claim 54, said apparatus further comprising:
second calculating means for calculating a text indicator value, C; and
comparing means for comparing said text indicator value with a threshold value, wherein said labelling of each discrete sample value within each text region is based on said comparison.

66. The apparatus according to claim 65, wherein said text indicator, C, is of the form:

$C = \max(|P_0 - P_i|), \quad i \in 1,..,8$

and wherein i is the index of the 8 nearest neighbour discrete sample values to a centre discrete sample value, *P0*.

67. The apparatus according to claim 65, wherein said means for identifying performs a cleaning operation on said text labels.

68. The apparatus according to claim 67, wherein said cleaning operation is a morphological opening operation.

69. The apparatus according to claim 54, wherein said first calculating means is configured to carry out the following functions:

calculating edge response values for each of said discrete sample values;
calculating a gradient magnitude value based on said edge response values;
comparing said gradient magnitude value with a threshold value;
classifying a current pixel on the basis of said comparison;
calculating said angle of orientation for a current pixel based on said comparison; and
storing said angle of orientation.

70. The apparatus according to claim 69, wherein said gradient magnitude value, Gm , is of the form:

$G_m = \sqrt{G_v^2 + G_h^2}$, and

wherein Gv and Gh are the vertical and horizontal edge responses, respectively.

71. The apparatus according to claim 69, wherein said edge gradient value, $G6$, is of the form:

$G_\theta = \tan^{-1} \frac{G_v}{G_h}$,

wherein Gv and Gh are the vertical and horizontal edge responses, respectively.

72. The apparatus according to claim 54, wherein said manipulating means is configured to carry out the following functions:

(i) accumulating a number of discrete data values of each angle of orientation for one of a plurality of portions of said discrete data values;

(ii) calculating a highest value and lowest value of discrete sample values for each angle of orientation;

(iii) comparing said highest and lowest values with highest and lowest threshold values, respectively;

(iv) reassigning an angle of orientation of said discrete data values of said portion on the basis of said comparison; and

(v) repeating the above functions (i) to (iv) for each of said portions of said discrete data values.

73. The apparatus according to claim 72, wherein said plurality of portions of said discrete data values is five portions.

74. The apparatus according to claim 54, wherein a modified cubic interpolation kernel is applied to a discrete data value which is labelled as text.

75. The apparatus according to claim 74, wherein said modified cubic interpolation kernel, *h(s)*, is of the form:

$$h(s) = \begin{cases} 1, & -d < s \le d \\ 0, & (1-d) \ge s > (1-d) \\ 2\left|\dfrac{s-d}{1-2d}\right|^3 - 3\left|\dfrac{s-d}{1-2d}\right|^2 + 1, \end{cases}$$

wherein $s = t/\Delta t$ is a normalised coordinate that has integer values at a sample point and $0 \leq d < 0.5$.

76. The apparatus according to claim 74, wherein a steerable cubic interpolation kernel is applied to a discrete data value which is classified as an edge.

77. The apparatus according to claim 76, wherein said steerable cubic interpolation kernels, *h(sx,sy)*, are of the form:

$$h(s_x, s_y)_{\theta=0} = \frac{1}{\sqrt{2}} \left\{ h(s_x)_{c=0.5} \cdot h(s_y)_{c=0} \right\}$$

$$h(s_x, s_y)_{\theta=\pi/2} = \frac{1}{\sqrt{2}} \left\{ \mathrm{h}(s_x)_{c=0} \cdot h(s_y)_{c=0.5} \right\}$$

$$h(s_x, s_y)_{\theta=\pi/4} = \frac{1}{\sqrt{2}} \left\{ h\left(\frac{s_x + s_y}{2}\right)_{c=0.5} \cdot h\left(\frac{s_x - s_y}{\sqrt{2}}\right)_{c=0} \right\}$$

$$h(s_x, s_y)_{\theta=3\pi/4} = \frac{1}{\sqrt{2}} \left\{ h\left(\frac{s_x + s_y}{\sqrt{2}}\right)_{c=0} \cdot h\left(\frac{s_x - s_y}{2}\right)_{c=0.5} \right\}$$

wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

78. The apparatus according to claim 76, wherein a conventional cubic interpolation kernel is applied to a discrete data value which is classified as smooth.

79. The apparatus according to claim 78, wherein said conventional cubic interpolation kernel is of the form:

$$h(s) = \begin{cases} (2 - \frac{3}{2}b - c)|s|^3 + (-3 + 2b + c)|s|^2 + (1 - \frac{1}{3}b), & |s| \leq 1 \\ (-\frac{1}{6}b - c)|s|^3 + (b + 5c)|s|^2 + (-2b - 8c)|s| + (\frac{4}{3}b + 4c), & 1 < |s| \leq 2 \\ 0, & Otherwise \end{cases}$$

and wherein $b = 0$ and $c = 0.5$.

80. A computer readable medium for storing a program for an apparatus which processes data, said processing comprising a method of interpolating image data comprising a first mapping of discrete sample values, said program comprising:

code for identifying text regions within said first mapping and labelling each discrete sample value within each text region;

code for calculating edge information for each of said discrete sample values of said image data to identify edge sample values and storing an angle of orientation for each of said edge sample values;

code for combining said labels and said angle of orientation for each of said discrete sample values to form a second mapping of said discrete sample values;

code for manipulating said angle of orientation for each edge sample value within said second mapping to form a third mapping of said discrete sample values;

code for manipulating said image data of said third mapping to form a fourth mapping of said image data; and

code for interpolating each sample value of said fourth mapping with a first one of a plurality of kernels depending on said labels and said angle of orientation of each of said sample values of said fourth mapping to form a fifth mapping of said image data.

81. The computer readable medium according to claim 80, said program further comprising:

code for associating each discrete sample value of said fourth mapping with a corresponding discrete sample value of said third mapping;

code for scaling said third mapping of said image data based on said association.

82. The computer readable medium according to claim 80, wherein said program further comprises code for interpolating said image data of said third mapping using a second kernel.

83. The computer readable medium according to claim 82, wherein said second kernel is an NN interpolation kernel.

84. The computer readable medium according to any one of claim 80, wherein said labels and said angle of orientation of each of said sample values of said fourth mapping are used to select kernel parameter values of said first kernel.

85. The computer readable medium according to claim 80, wherein said first kernel is a universal interpolation kernel, *h(s)*.

86. The computer readable medium according to claim 85, wherein said universal interpolation kernel, *h(s)*, is of the form:

$$h(s)=\begin{cases}1, & 0\le|s|\le d\\ (2-\frac{3}{2}b-c)\left|\frac{s-d}{1-2d}\right|^3+(-3+2b+c)\left|\frac{s-d}{1-2d}\right|^2+(1-\frac{1}{3}b), & d<|s|\le 1-d\\ 0, & 1-d<|s|\le 1+d\\ (-\frac{1}{6}b-c)\left|\frac{s-3d}{1-2d}\right|^3+(b+5c)\left|\frac{s-3d}{1-2d}\right|^2+(-2b-8c)\left|\frac{s-3d}{1-2d}\right|+(\frac{4}{3}b+4c), & 1+d<|s|\le 2-d\\ 0, & Otherwise\end{cases}$$

wherein $s = t/\Delta t$ and $0 \le d < 0.5$.

87. The computer readable medium according to claim 80, wherein said plurality of kernels are given by:

$$h(s_x,s_y)_{\theta=0}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5}\cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2}=\frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0}\cdot h(s_y)_{c=0.5}\right.$$

$$h(s_x, s_y)_{\theta=\pi/4} = \frac{1}{\sqrt{2}}\left\{ h\left(\frac{s_x + s_y}{2}\right)_{c=0.5} \cdot h\left(\frac{s_x - s_y}{\sqrt{2}}\right)_{c=0} \right\}$$

$$h(s_x, s_y)_{\theta=3\pi/4} = \frac{1}{\sqrt{2}}\left\{ h\left(\frac{s_x + s_y}{\sqrt{2}}\right)_{c=0} \cdot h\left(\frac{s_x - s_y}{2}\right)_{c=0.5} \right\}$$

wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

88. The computer readable medium according to claim 80, wherein the labels take precedence over said angle of orientation when forming said second mapping of said discrete sample values

89. The computer readable medium according to claim 80, wherein said fourth mapping is at a different resolution to said first mapping.

90. The computer readable medium according to claim 80, wherein said image data is colour image data.

91. The computer readable medium according to claim 80, said program further comprising:

code for calculating a text indicator value, C; and

code for comparing said text indicator value with a threshold value, wherein said labelling of each discrete sample value within each text region is based on said comparison.

92. The computer readable medium according to claim 91, wherein said text indicator, C, is of the form:

$$C = \max(|P_0 - P_i|), \quad i \in 1,..,8$$

and wherein i is the index of the 8 nearest neighbour discrete sample values to a centre discrete sample value, $P0$.

93. The computer readable medium according to claim 91, said program further comprising:

code for performing a cleaning operation on said text labels.

94. The computer readable medium according to claim 93, wherein said cleaning operation is a morphological opening operation.

95. The computer readable medium according to claim 80, said program further comprising:

code for calculating edge response values for each of said discrete sample values;

code for calculating a gradient magnitude value based on said edge response values; and

code for comparing said gradient magnitude value with a threshold value;

code for classifying a current pixel on the basis of said comparison;

code for calculating said angle of orientation for a current pixel based on said comparison; and

code for storing said angle of orientation.

96. The computer readable medium according to claim 95, wherein said gradient magnitude value, Gm, is of the form:

$G_m = \sqrt{G_v^2 + G_h^2}$, and

wherein Gv and Gh are the vertical and horizontal edge responses, respectively.

97. The computer readable medium according to claim 95, wherein said edge gradient value, $G6$, is of the form:

$$G_\theta = \tan^{-1} \frac{G_v}{G_h},$$

wherein Gv and Gh are the vertical and horizontal edge responses, respectively.

98. The computer readable medium according to claim 80, said program further comprising:

code for accumulating a number of discrete data values of each angle of orientation for one of a plurality of portions of said discrete data values;

code for calculating a highest value and lowest value of discrete sample values for each angle of orientation;

code for comparing said highest and lowest values with highest and lowest threshold values, respectively; and

code for reassigning an angle of orientation of said discrete data values of said portion on the basis of said comparison.

99. The computer readable medium according to claim 80, wherein a modified cubic interpolation kernel is applied to a discrete data value which is labelled as text.

100. The computer readable medium according to claim 98, wherein said modified cubic interpolation kernel, *h(s)*, is of the form:

$$h(s) = \begin{cases} 1, & -d < s \le d \\ 0, & (1-d) \ge s > (1-d) \\ 2\left|\frac{s-d}{1-2d}\right|^3 - 3\left|\frac{s-d}{1-2d}\right|^2 + 1, & \end{cases}$$

wherein $s = t/\Delta t$ is a normalised coordinate that has integer values at a sample point and $0 \le d < 0.5$.

101. The computer readable medium according to claim 80, wherein a steerable cubic interpolation kernel is applied to a discrete data value which is classified as an edge.

102. The computer readable medium according to claim 101, wherein said steerable cubic interpolation kernels, $h(sx,sy)$, are of the form:

$$h(s_x,s_y)_{\theta=0} = \frac{1}{\sqrt{2}}\left\{h(s_x)_{c=0.5} \cdot h(s_y)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=\pi/2} = \frac{1}{\sqrt{2}}\left\{\mathrm{h}(s_x)_{c=0} \cdot h(s_y)_{c=0.5}\right.$$

$$h(s_x,s_y)_{\theta=\pi/4} = \frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{2}\right)_{c=0.5} \cdot h\left(\frac{s_x-s_y}{\sqrt{2}}\right)_{c=0}\right\}$$

$$h(s_x,s_y)_{\theta=3\pi/4} = \frac{1}{\sqrt{2}}\left\{h\left(\frac{s_x+s_y}{\sqrt{2}}\right)_{c=0} \cdot h\left(\frac{s_x-s_y}{2}\right)_{c=0.5}\right\}$$

wherein $s_x = x/\Delta x$ and $s_y = y/\Delta y$ are re-sampling distances in the horizontal and vertical directions, respectively, and . indicates matrix multiplication.

103. The computer readable medium according to claim 101, wherein a conventional cubic interpolation kernel is applied to a discrete data value which is classified as smooth.

104. The computer readable medium according to claim 101, wherein said conventional cubic interpolation kernel is of the form:

$$h(s) = \begin{cases} (2-\frac{3}{2}b-c)|s|^3 + (-3+2b+c)|s|^2 + (1-\frac{1}{3}b), & |s| \le 1 \\ (-\frac{1}{6}b-c)|s|^3 + (b+5c)|s|^2 + (-2b-8c)|s| + (\frac{4}{3}b+4c), & 1 < |s| \le 2 \\ 0, & \mathit{Otherwise} \end{cases}$$

and wherein $b = 0$ and $c = 0.5$.